



**STRATEGY  
RESEARCH  
PROJECT**

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**THE NATIONAL GUARD REVOLUTION IN  
MILITARY TRAINING AFFAIRS**

**BY**

**DTIC QUALITY INSPECTED 4**

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USAWC STRATEGY RESEARCH PROJECT

The National Guard Revolution in Military Training  
Affairs

by

LTC Alan C. Gayhart

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## **ABSTRACT**

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Training of the mechanized forces of the Army National Guard (ARNG) to meet expected training readiness levels, including earlier deployment times, provides unique challenges to ARNG units. Combined with the inherent challenges of time, distance, and equipment availability, these mechanized units must change the methods and strategy previously utilized to train their soldiers. This paper provides a brief history of simulation in the ARNG and describes simulation technology currently being utilized and developed for high priority, ARNG enhanced brigades. It discusses the challenges to training and how current and future simulation systems can be molded to provide enhanced training opportunities under the Synthetic Theater of War concept. It maintains that by utilizing simulation technology and a focused training strategy, mechanized units can achieve a higher level of training readiness and proficiency, while reducing the time and resource costs of conducting numerous live gunnery and maneuver exercises. These units can be available for deployment much earlier than the 90 days required for ARNG brigades mobilized for the Gulf War.



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The National Guard is an integral part of the Total Force Policy. Moreover, the lack of a major peer competitor and the resulting decrease in the military budget, places increased reliance on the Guard for early deployment and commitment to troublespots throughout the world. For example, thirteen Army National Guard Enhanced Separate Brigades (EB) are designated for deployment in current Army war plans. Additionally, the Army National Guard's (ARNG) divisions are organized and equipped to augment the active force. These units are likely to deploy much earlier than was planned in the Cold War era when the US maintained a large active force. The question is how do these ARNG mechanized units achieve this increased level of readiness, when past practices have shown it impossible to attain?

This paper proposes that by utilizing emerging simulation technologies and integrating a focused training strategy, mechanized combat units of the ARNG can achieve a high level of training readiness and proficiency, while decreasing the time and resource costs of conducting live gunnery and maneuver exercises. These units can be available for deployment much earlier than the 90 days required for the Army National Guard brigades mobilized for the Gulf War.<sup>1</sup>

The continual downsizing of the active Army does not provide a vast pool of forces to deal with crisis situations affecting US interests throughout the world. During Operation Desert Storm, the Army committed the majority of it's forces to this crisis. That same force does not exist today in the active Army. The ARNG will be utilized in the future to fill this vital shortfall in forces.

However, the combat units of the ARNG do not have the luxury of extended post-mobilization periods. To ensure that the US has the necessary force available to rapidly deal with future threats to US interests, forces must attain and sustain maneuver and gunnery skills at the Task Force level prior to mobilization. Brigades must attain the necessary skills of synchronizing and integrating the battlefield operating systems during pre-mobilization training periods. Post-mobilization should be a final validation of the brigade's combat readiness. Retraining on limited tasks may occur during this period, however the majority of the critical mission tasks must be attained prior to mobilization.

The ways and means that these units achieve this heightened state of readiness requires an open minded, revolutionary approach to finding new and efficient methods of training. The

Gulf War highlighted the potential of technology to shape and control the battlefield. The United States military places great emphasis on envisioning the future to determine the appropriate technology, force structure, and doctrine to meet the challenges of the 21<sup>st</sup> century. For example, the Force XXI initiatives are moving the Army towards a revolution in military affairs (RMA) defined as "a fundamental advance in technology, doctrine or organization that renders existing methods of conducting warfare obsolete."<sup>2</sup>

Supporting the current RMA is a revolution in military training affairs (RMTA), that this paper defines as a parallel advance in technology, doctrine or organization that supports the on-going RMA by rendering existing methods of conducting training obsolete. Similar to the methods of integrating high technology into the conduct of the Gulf war, this revolution in training affairs must integrate technology to educate soldiers and sustain their training more efficiently and effectively than past practices.

This RMTA for ground combat forces began in the early 1980's with the ARNG's participation in a TRADOC sponsored test of then, high technology training devices and simulations to train tank crews.<sup>3</sup> This was an early attempt to utilize technology to train

soldiers on gunnery skills while reducing ammunition other resource expenditures.

The ARNG continues to be a key component in the development of future training technologies. Currently two ARNG Enhanced Separate Brigades are training with technology provided by a Defense Advanced Research Projects Agency (DARPA) project. Both of these brigades are trained and certified at the company and battalion level, and conduct normal NTC rotations to validate at the brigade level. This project, called the Simulation in Training for Advanced Readiness (SIMITAR), is a proven alternative that Active and Reserve maneuver forces can utilize to maximize training opportunities and increase the total training readiness of the force.

The study proposes that by applying technology and a structured and focused training strategy, combat units of the ARNG can achieve higher levels of training readiness and reduce the amount of time spent in post-mobilization training. Time and resource intensive exercises, such as live gunnery and maneuver exercises, can be greatly reduced while increasing the sustainment of critical combat skills by these units.

Ensuing parts of the this paper will look at the challenges faced by the ARNG in training and sustaining this training.

Furthermore, methods to overcome these challenges by utilizing simulations and a training strategy focused on critical combat skills will be offered, including the associated benefits, shortfalls, and costs of these systems. Options for training combat units utilizing a compressed gunnery strategy and the establishment of regional Synthetic Theater of War (STOW) centers will be explored. In conclusion, this paper will make recommendations for future changes to the ARNG training strategy, funding and implementation of training systems, and training readiness levels for mechanized combat units of the ARNG.

### **CURRENT CHALLENGES TO TRAINING**

The ARNG faces unique challenges that influence the training of its' soldiers. Time, distance, equipment availability, and personnel turbulence all affect the training readiness of ARNG units. These factors are inherent due to the fact that units are organized and stationed at local community armories. In addition, these citizen soldiers must also devote the necessary time to their family priorities and civilian jobs.

Time to train is the most significant challenge influencing ARNG readiness. ARNG units are officially allocated 39 days per year for all activities. Preparation time, travel time and

administrative tasks further reduce the actual training time available. The weekend Inactive Duty Training (IDT) periods are normally conducted at local armories where units conduct individual training. The Annual Training (AT) period typically consists of 15 continuous days of collective training, conducted at an RC or AC training area. At best, ARNG units have less than 25% of the training time available to active units.

The other major challenge detracting from the Guard's readiness is the dispersion between units and the geographical placement of equipment. The typical company sized unit is located in another community than its' higher headquarters, sometimes up to 300 miles away. In addition, the majority of the unit's heavy vehicles, tanks, APC's, howitzers, are normally placed at Mobilization and Training Equipment Sites (MATES) located at the unit's annual training site. Few vehicles are actually located and available at local armories for the soldiers to train with, and most (if the unit has one) local training areas do not support crew level gunnery or maneuver exercises.

Consequently, the lack of time and availability of equipment frequently prevent the unit from conducting both individual and collective training during weekend IDT periods. Thus prime training time at the AT period, which should be characterized by

company and battalion collective training, must be utilized to train soldiers in basic individual and crew tasks.

To overcome these challenges to readiness, the National Guard Bureau decided to seek ways to improve both soldier and unit capability by utilizing existing and developing technology.<sup>4</sup> Two major programs capitalize on technology to overcome these challenges - distant learning and Project SIMITAR.

### **DISTANCE LEARNING**

The Distant Learning program strives to overcome the challenges of distance and time. Distance Learning involves using available instructional technologies - print, video tape, computer-based training, interactive videodisk, video teleconferencing - to deliver training to a student's training location or home. This is one cost-effective way to overcome the geographical dispersion and limited training time associated with ARNG training.<sup>5</sup>

Distance Learning also has the ability to provide training lessons on CD-ROM. The soldier can conduct training at home with either a personal computer or a unit issued laptop computer. Unit computers should have CD-ROM capability to allow for training at the unit location. Since increasing numbers of

computers with CD-ROMs and modems are located at most units and soldiers homes, a limited number of unit issued laptops would be available for those soldiers without computers. The number of hard copy individual training manuals that TRADOC sends to units should be decreased, and replaced by CD-ROM modules that train the same tasks through interactive involvement with the soldier.

A local area network (LAN) with the unit's main frame computer would provide additional training programs to the soldier at his home and also support similar work stations in the armory. Once this unit LAN is established, on-line training programs offered by TRADOC could also be provided (Figure 1).

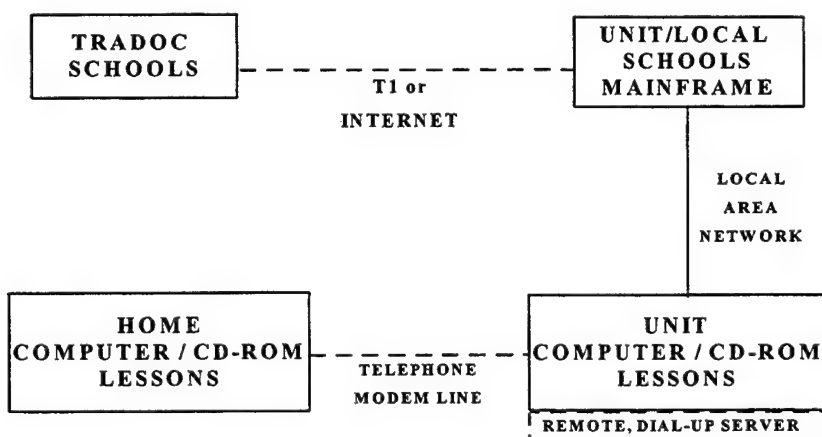


Figure 1

The use of distance learning provides soldiers with the ability to train on individual skills at any time. Soldiers can

learn new skills or sustain their skills beyond the time restraints of the normal weekend drill period. Linking individual training with an outreach capability to the soldier will continue to be more cost effective and productive than producing volumes of printed materials or expending valuable unit training time on individual skills training. As a result, the use of this technology, particularly at the soldier's home or armory, becomes a timesaving and cost-effective approach to enhance individual proficiency.<sup>6</sup>

### **PROJECT SIMITAR**

The Army began an experiment called Project SIMITAR (Simulations for Advanced Readiness in Training) in an attempt to maximize the time available for reserve soldiers to train. SIMITAR is a Congressionally mandated program designed to dramatically improve the training and readiness of high priority Army National Guard combat brigades by injecting advanced technologies into their training programs. Commenced in 1991 by the Defense Advanced Research Projects Agency (DARPA), SIMITAR designed to create a near-ideal learning and training environment.<sup>7</sup> It increases the number of practices available for

learning a given task, improves the realism of the training and provides realistic, valuable feedback to the soldiers being tested.

The Government Accounting Office (GAO) noted that the Army previously used simulations to train soldiers on every possible task, rather than focusing the training on specific wartime tasks that support the unit's mission.<sup>8</sup> SIMITAR maximizes the use of existing and emerging off the shelf technology and structures them to meet the needs of the reserve soldier. Particular emphasis is given to the development of innovative training strategies that focus training energies on those critical tasks necessary for combat preparedness and the unit's wartime mission.

Retention of skills for reserve armor units and soldiers is highly perishable. Furthermore, the multitude of tasks involved, and the complexity of the weapon systems, challenge the soldiers in retaining the necessary skills. The amount of times that a soldier repeats a task has a direct correlation to the acquisition and retention of that task.<sup>9</sup> Simulation devices provide soldiers with the ability to train on a regular basis, and retrain repetitively on difficult tasks until they are mastered.

The desired endstate of the project is a process that will enable Army National Guard units to significantly enhance their combat readiness through the use of low-cost technologies and simulations at their local armories, or even in their own homes through interactive computer technology, to compress the equivalent of 90 days of post-mobilization training into 30 to 45 days.<sup>10</sup> This cost of this technology can offset by the savings made in ammunition, transportation, fuel and other costs associated with the current method of utilizing live fire gunnery and maneuver exercises to train mechanized combat units.

Training technologies developed under SIMITAR, or closely supporting the concept of the program, fall under three main categories: individual/CSS, collective, and battle staff synchronization systems.

### **Individual/CSS Training Systems**

The first group of systems focus on training individual soldiers on specific, individual MOS (Military Occupational Specialty) tasks. These tasks are not generic to all soldiers, but are the distinct skills necessary for the individual tanker, infantryman, mechanic, medic, etc. to be proficient in his job.

The following are some of the individual systems currently being utilized:

a. Virtual Reality Maintenance Training Simulator (VMAT):

The VMAT is a low-cost, interactive PC-based simulation. It provides organizational and direct support maintenance personnel with a virtual series of dynamic, flexible, three-dimensional interactive scenarios. It supports classroom, on-site field environment and home station training for the M1A1 Tank and M2 Bradley Fighting Vehicle and Direct Support (DS) level training on troubleshooting the TOW 2 missile system.<sup>11</sup>

b. Battle Staff Training System (BSTS): The BSTS is a multi-media computer with CD-ROM and supporting text materials. The CD-ROM discs provide numerous, interactive training lessons for the various individual staff officers (S-1, S-2, S-3, S-4, XO, BMMO). The programs provide training on critical staff skills necessary for a member of a Battalion or Brigade staff.<sup>12</sup>

c. Pen-Based, Electronic Network for Command Information Linking (PENCIL): The PENCIL system is based on a laptop computer with the necessary upgrades to support high level graphic production and high speed data transmission. PENCIL laptops are issued to all company and higher commanders and primary staff officers within the brigade. The laptops have

telephone and cellular modem dial-up capability and are linked via a 800 phone number to a central server. Users are able to display maps of available training areas (NTC, Ft. Knox, Gowen Field, etc.), draw on the graphic, and send these electronic map overlays and formatted messages to another user. In addition, e-mail and basic data transmission features are included. PENCIL allows commanders and staff to not only communicate easier, but allows for the rapid transmission of written and printed training materials.<sup>13</sup> This system provides commanders and staffs the means to communicate and coordinate whenever is required, not just during the established drill period. This assists in preparing and training leaders prior to drill, so that the focus of the weekend training period can be devoted to collective training of the unit.

### **Collective Training Systems**

The second group of systems are designed to hone critical battlefield skills for mounted and dismounted combat forces at a fraction of the cost of expending ammunition and other resources. They also save limited training time used in the preparation and travel to/from training areas.<sup>14</sup> These devices increase tactical and gunnery proficiency of crews, platoons, and units. When used

as part of a methodical training strategy, they provide the means to not only meet the required level of readiness, but replace many resource intensive, live-fire gunnery and tactical exercises.

a. The Conduct of Fire Trainer (COFT) supports the M1 series tank and the M2 Bradley Fighting Vehicle. Since the early 1980's, it has been the primary simulator utilized by the Army to train the gunner/vehicle commander combination. It is configured in either a fixed site or mobile version, but requires a specially designed concrete pad and electrical service in either configuration. The COFT computer scores each of the simulation engagements and lists procedural faults conducted by the students. An evaluator controls the computer system, and selects the engagement or re-engagement of scenarios. He also records the communication between the crewmen and conducts an After-Action Review (critique) of the exercise with the crewmen.

This system has proven to increase the proficiency of the two crewmen working as a team, but fails to train the entire crew, including the loader and driver. Live fire qualification requires close coordination between all members of the tank/Bradley crew, which COFT fails to provide. The extreme cost (in excess of \$1 million) limits issue of this system to one per

battalion. Thus 58 crews of a battalion must share a single simulator. The unique set-up and operational needs, and inability to train entire crews makes this device a very limited training tool.

b. To meet the need to train entire crews, SIMITAR developed the Full-crew Inter-active Simulation Trainer (FIST). It supports either the Abrams tank or the Bradley Fighting Vehicle. The FIST is a full crew, vehicle appended training simulator. It is appended to a powerless, stationary, sheltered M1 or Bradley. Computer monitors in front of all vision blocks provide a view of the scenario to each of the four crewmen (Figure 2). Cabling from the master PC computer attaches to cabling within the vehicle and the monitors. The evaluator operates the main computer and selects the scenarios to be conducted and scored. As in the COFT, the evaluator records the communications between the crewmen, and utilizes this and the computer scoring for the conduct of the AAR.

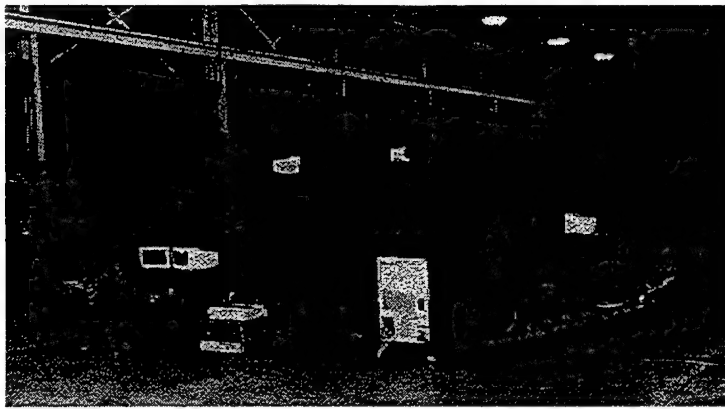


Figure 2

Advantages of the FIST are the inclusion of the entire crew, and the utilization of a real-world vehicle, with all of the associated restraints (confined space, sharp edges, etc.). Each of the crewmen must accomplish his duties, much as he would in combat, for the crew to succeed.

Although this system trains the entire crew, it lacks the ability to train the loader in loading the round, and the commander firing the .50 caliber machine gun. Although the loader can train loading dummy rounds, training on the machine gun must occur on a gunnery range to permit actual firing of the machine gun. This can be accomplished during the necessary calibration phase prior to qualification.

This system has been successfully utilized by the two ARNG enhanced brigades to replace all of the gunnery tables leading up to Tank Table VIII qualification. Crews are able to re-fire as

many times as necessary within the simulator, with no additional cost as would be seen if fired using actual ammunition. This provides a significant cost savings in ammunition expenditure, while allowing crews the opportunity to further enhance their gunnery skills (Figure 3 and 4).

#### Gunnery Conducted without Simulation

	.50 Cal	7.62 mm	SABOT	HEAT
Calibrate			4	2
IV	250	700		
VI	50		10	4
VII	50	150	22	8
Total/Tank	350	850	36	14
Bn Total	20300	49300	2088	812
Cost	\$27,608.00	\$18,241.00	\$1,459,344.96	\$778,561.84

Figure 3

#### Gunnery Conducted with Simulation

	.50 Cal	7.62 mm	SABOT	HEAT
Calibrate			4	2
IV	0	0		
VI	0		0	0
VII	0	0	0	0
Total/Tank	0	0	4	2
Bn Total	0	0	232	116
Cost	\$0.00	\$0.00	\$162,149.44	\$111,223.12

Figure 4

The savings in one battalion gunnery rotation, not including ammunition spent in refiring on preliminary gunnery tables, is significant (Figure 5).

Cost: W/O	\$27,608.00	\$18,241.00	\$1,459,344.96	\$778,561.84
Cost: With	\$0.00	\$0.00	\$162,149.44	\$111,223.12
	<u>\$27,608.00</u>	<u>\$18,241.00</u>	<u>\$1,297,195.52</u>	<u>\$667,338.72</u>
Total Savings	<u>\$2,010,383.24</u>			

Figure 5

The cost of the FIST prototypes are approximately \$200K. When these systems go into full production, the cost is expected to drop. Thus for the price of one COFT, 4-5 FISTs can be acquired. This greatly increases the number of gunnery systems to a battalion. FIST provides a much improved training system at a greatly reduced cost. This cost can be rapidly recovered through the cost saving in ammunition.

c. Engagement Skills Trainer (EST): The EST is an interactive computer and video system that accommodates as many as fifteen infantry individual and squad weapons ranging from M9 pistols, to M60 machine guns. EST also supports indirect fire weapons such as the 60mm and 120mm mortars. The EST is set up in

a classroom, motor pool, or other room that can block direct sunlight. The system uses a wide-screen image projection and actual weapons modified with eye-safe laser emitters. Every shot fired on the system is recorded and scored to provide feedback not only for individual, but squad fire control measures. Scenarios can be developed to train soldiers in "judgmental" situations they may find themselves in, particularly in Operations Other Than War (OOTW) environment.<sup>15</sup>

EST provides for the infantry squad, what the FIST provides for the armor crew. Many of the required small arms qualification tables can be conducted at home station. The \$150K cost of this device can be recovered by the cost savings realized by eliminating ammunition, transportation, and range operation costs associated with basic weapons training. Soldiers can train repetitively, at home station, to hone their gunnery and squad C2 skills, with no increase in resource costs. Annual training periods can then focus on critical fieldcraft, maneuver, and collective unit training tasks, without diverting time and resources to gunnery, fire control, and squad command and control.

d. Simulation Network - Mobile (SIMNET): The mobile SIMNET incorporates two semi-trailers containing four simulated M-1

interiors. This system is used throughout the Army and the ARNG. A reconfigurable system that supports both M-1 and M-2 Bradley is also utilized within the ARNG<sup>16</sup>. The primary task of SIMNET is to train tactical skills, rather than precision gunnery skills, to combat units from crew through battalion level. However, when incorporated with other simulation devices, it has successfully replaced Gunnery Table XI, which supports live fire, platoon gunnery qualification Table XII.

Although SIMNET is an excellent trainer, it does have several weaknesses such as not fully supporting all of the battlefield operating systems(BOS). The planned follow-on system for SIMNET is the Close Combat Tactical Trainer (CCTT) that improves on SIMNET's performance and fully supports all BOS. The advantage of the mobile SIMNET/CCTT is that it can be moved to support various ARNG units within a region. ARNG SIMNETs have been modified to allow linking numerous SIMNETs across the nation through the Defense Simulation Internet (DSI).<sup>17</sup> In this case, these SIMNETS allow ARNG units to conduct command and control exercises concurrently with other SIMNETS located within the ARNG or the Army.

e. Deployable Force on Force Instrumented Range System

(D-FIRST): DFIRST is a satellite based, Global Positioning System (GPS) instrumentation system that provides position location and engagement simulation for live maneuver exercises. It supports not only firing vehicles such as tanks and Bradleys, but supports location and kills upon non-combat vehicles such as trucks. It provides the ability to simulate weapon firing, casualty assessment, damage indication, incoming artillery fires, and virtual mine fields can be sown in the exercise area.

The system also provides an AAR capability, which replays an audio and video recording of the exercise. This includes the participant maneuvers, firing events, and casualty status, along with a synchronized playback of voice commands recorded from the tactical communications of both attacking and defending forces. The system can also be linked to the DSI network that can allow for direct interface with remotely located SIMNETs or JANUS locations.

It is critical that the maneuver training conducted during annual training periods be as challenging as that found at the CTCs. A NTC rotation should not be the first time that Guard units are introduced to instrumented force on force training. D-FIRST provides the means to conduct viable maneuver training

with a high quality AAR. The cost of D-First is similar to that of a comparable MILES package, yet provides superior training and review capability.

### **Battle Staff Synchronization Systems**

Janus is a constructive simulation model that simulates conflict between opposing forces. It is computer based, high resolution, interactive simulation using precise color graphics to portray realistic events during simulated combat. It has sufficient detail to portray individual fighting systems or individual soldiers. It has been successfully used to train platoon through brigade combat leaders and staff on tactical and decision making process activities. The system can input conditions (weather, terrain, visibility, logistic, etc.) that could be realistically faced on the battlefield. All battlefield operating systems are fully integrated into the play. JANUS can support continuous 24-hour operations including reconnaissance prior to start of the maneuver exercise followed by an intense logistical resupply scenario. The master recording and playback of major activities on a large screen monitor provide a greatly enhanced battle analysis and AAR capability. DARPA has modified JANUS to allow networking of remote JANUS sites via a common

telephone modem connection.<sup>18</sup> This allows a unit to conduct a brigade level exercise with the subordinate battalions participating from their home stations. This allows brigades to train the entire combat team without the resource burden of co-locating vehicles and personnel at one location.

Two other systems currently in use by the Army are the Brigade/Battalion Simulation System (BBS) and the Corps Battle Simulation (CBS) system. Both systems consist of computers networked together to provide the driver for CPX or command and staff training. Both simulation systems operate as a two-sided, free play, real time training environments.

a. The BBS system provides battalion and brigade commanders and their staffs an environment to train in the execution of battle doctrine at the tactical level of war. It provides tactical simulation in air and ground warfare between opposing units and the resupply, medical, and maintenance required to support the conflict.<sup>19</sup> It is a high resolution model that represents weapon and support system at the item level. It can be linked, via the DSI network, to other simulation systems.

b. CBS is similar to BBS, but is designed to train Corps/Division commanders and staff. It is used by the Battle Command Training Program (BCTP) and by the corps to train corps,

division, and brigade staffs. CBS is used in the BCTP Warfighters, Division/Corps train ups, REFORGER, etc.<sup>20</sup> CBS also interfaces with the DSI network system. It links with other remote systems, such as SIMNET and the Air Warfare Simulation system, utilized in the Synthetic Theater of War - Europe (STOW-E) simulation exercises.<sup>21</sup>

A future simulation currently under design is the Warfighter's Simulation 2000 (WARSIM 2000). It is designed to replace both BBS and CBS under the Force XXI initiative. WARSIM 2000 will portray all phases of Army combined arms operations in a land, air, and sea environment. These phases include mobilization, redeployment, operations for War and Other than War (OOTW), redeployment and demobilization.<sup>22</sup> In addition, WARSIM 2000 will portray operations at levels from battalion through echelons above corps. It will be capable of being networked through DSI and will support links to constructive and live simulation exercises under the Synthetic Theater of War (STOW) program. WARSIM 2000 will be the primary link for integrating the Army into the Joint Simulation System (JSIMS).<sup>23</sup>

## SYNTHETIC THEATER OF WAR (STOW) IN THE ARNG

One of the key implications of downsizing, increasing varieties of military mission, and the technological advances of Force XXI is the need to develop a supportive, seamless training system within the Army. This system must provide a full range of training capability to dominate the broad spectrum of future military operations.<sup>24</sup> *The capability to interconnect virtual, live, and constructive simulations for unit training across the full range of military operations will be necessary.*<sup>25</sup> Future simulation systems and devices, distance learning resources, and live maneuver/gunnery must be interconnected and networked to maximize available training time and resources, and adequately prepare forces for the broad spectrum of future operations. The three domains - virtual, constructive, and live, of the STOW concept incorporate many existing and future training technologies (Figure 6).

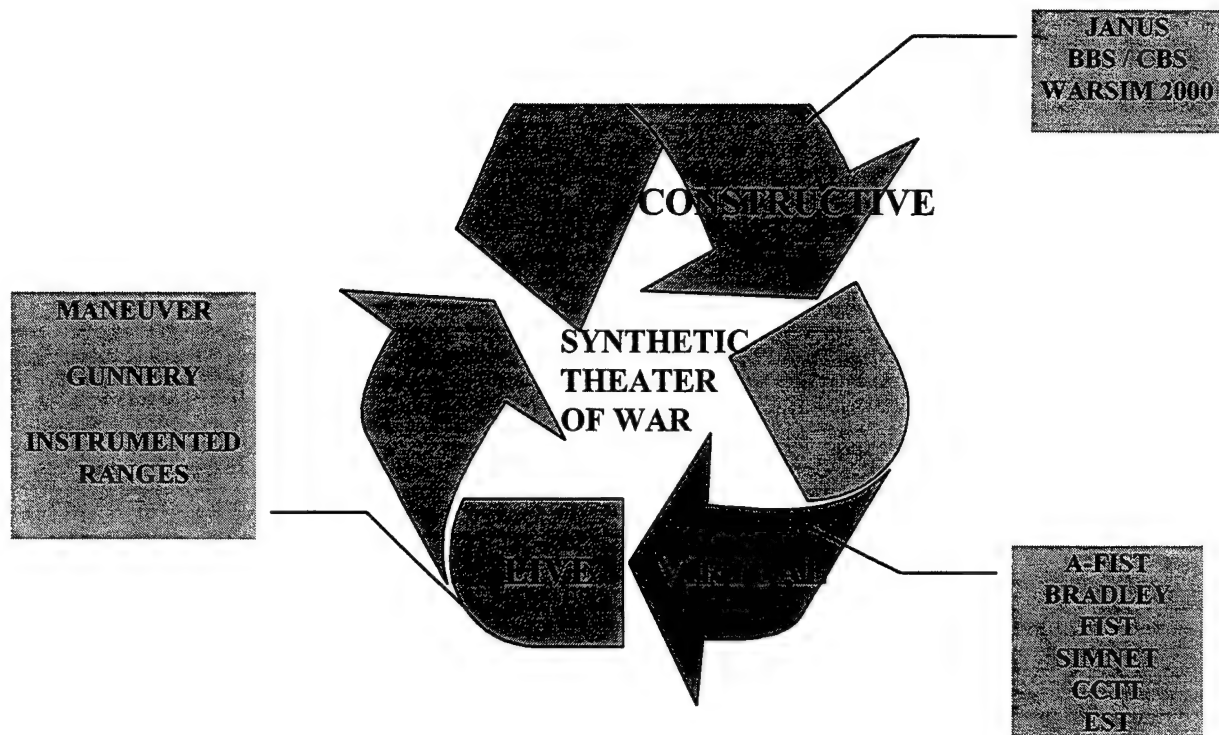


Figure 6

### Virtual and Constructive Device Integration

The ARNG has the current ability to merge simulation devices, including the SIMITAR devices, into this seamless web of systems. The concept of STOW within the ARNG is the utilization of these training systems independently, or collectively to train at the various echelons within a unit. For example, the virtual trainers (A-FIST, SIMNET, etc.) can be utilized to train on specific tasks by the soldiers. These same devices can be linked

through the DIS or a local LAN at the armory to provide a STOW cell of crews, platoons and units training collectively, and concurrently in a cyber-based, tactical environment. This allows the majority of all personnel in unit to train simultaneously on mission focused tasks, and maximize the amount of time available for training (Figure 7).

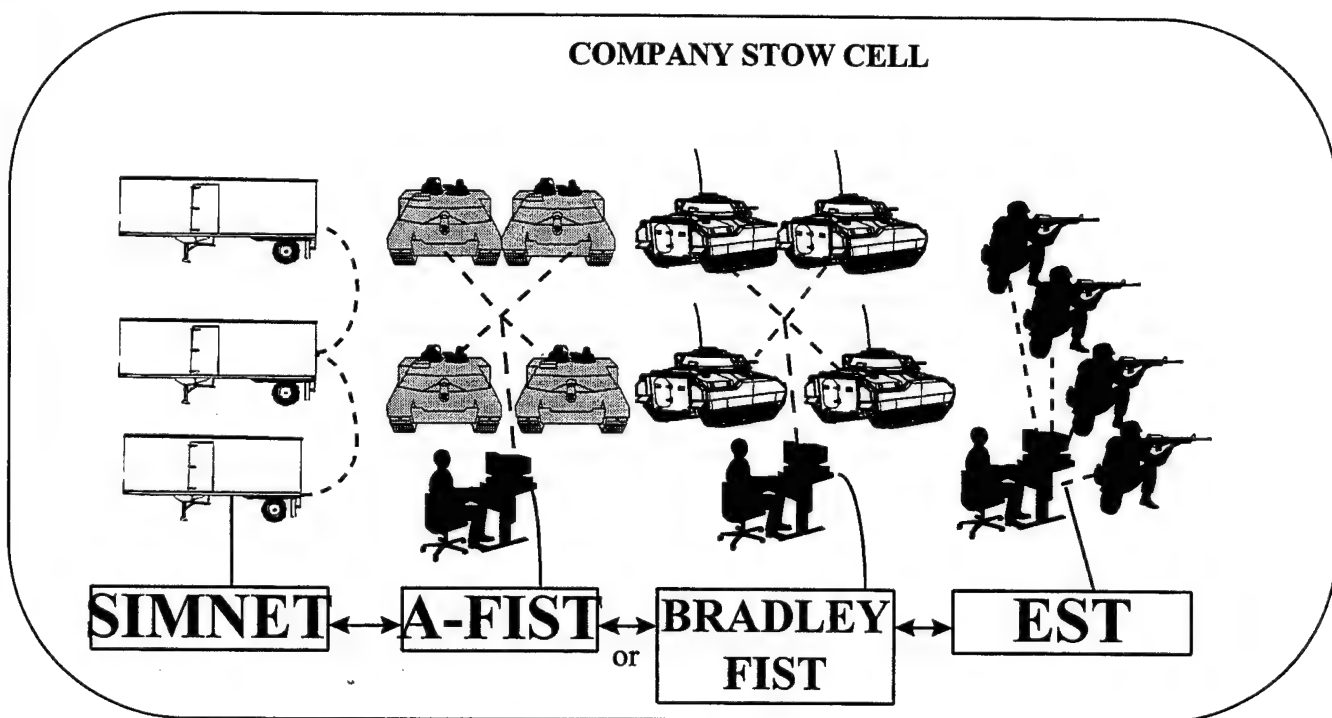


Figure 7

Using DIS would allow the interface of these virtual trainers with the constructive trainers such as JANUS. This would further expand the levels of concurrent training to include

additional command echelons and battlefield operating systems into the simulation. Depending on the number and availability of virtual systems (Company Cells), and the availability of units, it is possible to conduct a fully integrated, company through battalion or brigade exercise. The number of units included could be tailored to support the training strategy and schedule of the units (Figure 8).

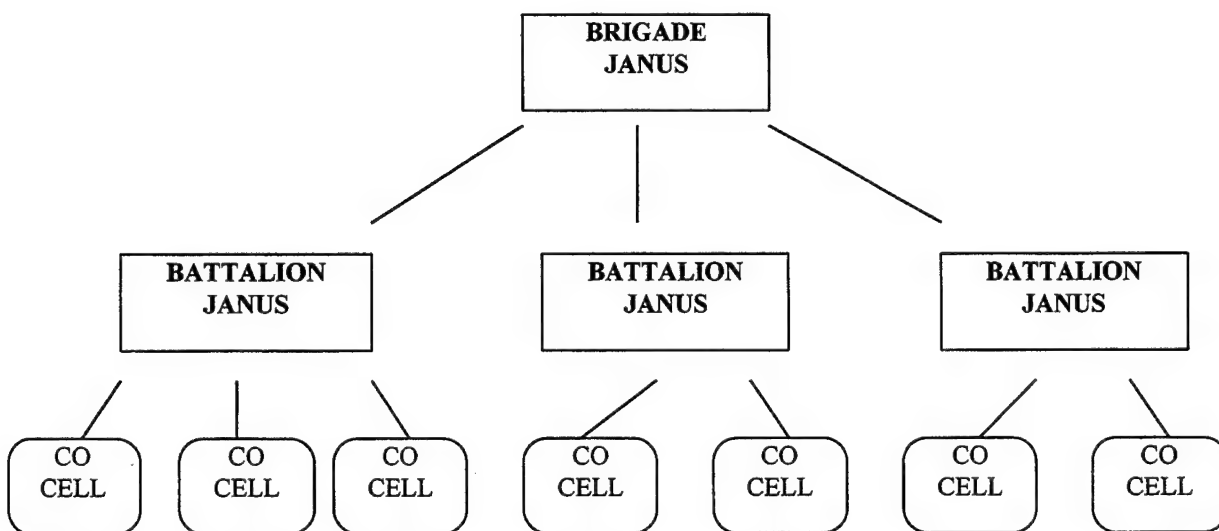


Figure 8

#### Live Integration

Virtual simulators, while greatly increasing the proficiency and knowledge of soldiers, must be balanced against the real

world challenges of maneuver and live fire gunnery. Simulation cannot entirely replicate the hazards, stress, and unknowns found on the battlefield. Thus, the soldier must still fire his weapon, operate vehicles cross country, and maneuver against an uncooperative enemy. Simulation systems can train many of the tasks involved with combat, but it will always be necessary to train other specific tasks utilizing real weapons, equipment, and ground maneuver. Live training is a critical element of the STOW triad.

Maneuver and gunnery can be seamlessly integrated into the STOW architecture by modifying existing force on force applications (such as D-FIRST) to link with virtual and constructive systems. A sample exercise could include the brigade or battalion staff operating on JANUS, commanding and fighting units whose input into the JANUS system is from remote SIMNET/CCTTs. The units in the SIMNET/CCTT are fighting the same battle, at their echelon with input from crew collective trainers, such as EST or A-FIST. The crews in these trainers fight the same battle, with output to the company and higher echelon simulation systems.

All of these simulation systems operate from the same terrain database, thus insuring that the digitized battlefield is

the same for all units. This digitized battlefield is a replication of the exact ground that another unit is conducting actual live gunnery or maneuver. All movement of units, whether real or simulated are transparent to the commands at all echelons (Figure 9). All Command, Control, Communication, Computer, and Intelligence (C4I) systems are operational throughout scope of the STOW battlefield.

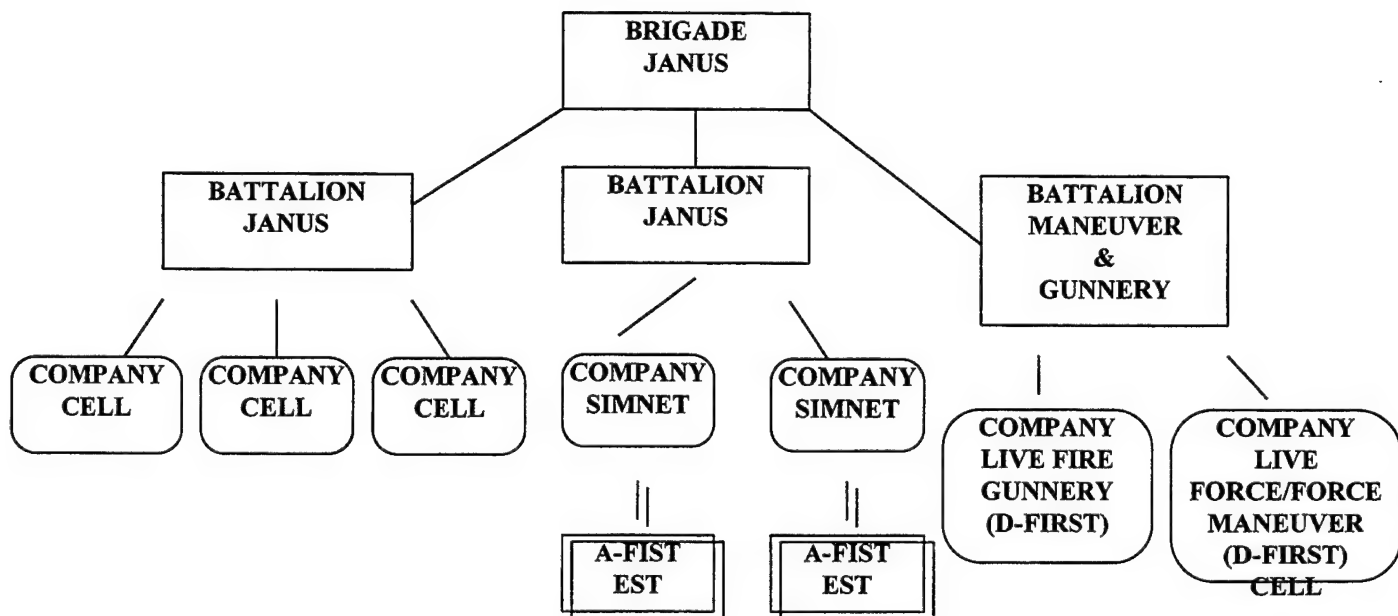


Figure 9

The use of STOW technology and strategy has been utilized on numerous occasions. Although not linked to live fire gunnery,

the STOW-E exercises conducted in Germany integrate all other components into a virtual battlespace that enhances the training at the Brigade level.<sup>26</sup>

The ARNG has also integrated these systems, including live fire gunnery, to train a heavy, EB during Annual Training '96 at the Orchard Training Area in Idaho. D-FIRST was used to instrument the opposing forces on live maneuver, but was also integrated with the existing targetry systems on the Multi-Purpose Range Complex (MPRC). The integration of D-FIRST to the target computer system on the range provided the necessary location and firing data necessary for integration into the STOW battlespace. Although lacking the DIS network necessary for full integration of all systems, the exercise allowed the brigade to focus it's training on key missions and tasks. This allowed the brigade to conduct company level live fire gunnery, in concert with battalion maneuver and brigade operations.

The enhanced and combat brigades of the ARNG can utilize STOW as the mechanism to link their training exercises to compatible exercises at Division or Corps. This will allow units that operate together after mobilization, such as a round-out RC brigade and it's parent AC division, to train simultaneously on focused missions. In addition, USACOM is currently sponsoring

testing of STOW to integrate both service and joint systems under one seamless training environment.<sup>27</sup> STOW will be the system utilized to plan, train, and rehearse future missions of the CINC and units assigned or appropriated to him.

### **Training Strategy**

The use of simulations allows soldiers to economically train on a multitude of tasks without the burden of transportation, ammunition, or other high cost resources. Since simulation can easily portray and replay training scenarios, the soldier or unit can train on tasks and missions until they are correctly accomplished. For example, a tank crew that has difficulty in engaging two targets from a moving tank, can fire that engagement as many times as necessary, in the FIST, until they have mastered the techniques required. If an Infantry squad has problems in fire distribution techniques, they can execute a platoon fire plan, using EST, repetitively until they become proficient in the task. Similar techniques can be utilized in training platoons or even brigade staffs on their respective warfighting skills. But simulations require a plan for efficient use to gain an identifiable endstate. To maximize the potential for these gains, and achieve proficiency in critical warfighting

skills, it is necessary to have a clear focus and strategy to attain these skills.

Simulations allow Army National Guard units to go well beyond what was normally the objective of a training year. The common, annual goal for most ARNG armor units is the successful qualification of 80% of assigned tank crews on crew qualification Table VIII. Maneuver goals primarily focus on the successful completion of platoon tactical training lanes and quarterly battalion / brigade staff training. The attainment of these goals is dependent various factors. Simulation can reduce the impact of not having sufficient transportation or training areas. It can also provide the means for sustainment of skills. However, a training strategy that focuses on maximizing the time that units spend training, and eliminating non-critical skill training is necessary.

Weekend IDT training should be spent on training the individual and crew skills necessary for gunnery and maneuver proficiency. By massing the available simulation devices, a unit is able to conduct multi-echelon training. By utilizing SIMNET, AFIST, MCOFT, and even EST, the unit is able to effectively train individual, crew, and platoon collective tasks simultaneously.<sup>28</sup> Each element conducts training on a simulator for a specified

time and then rotates to the next simulator. Time is also spent on individual skill training, such as the gunners skills test or common task training. Thus a platoon is able to train all of its soldiers on individual tasks, gunnery tasks, and platoon tactical training on the same weekend without leaving the armory.

The yearly training plan for gunnery training for an armor company could be as depicted in Figure 10. This compressed gunnery plan requires one live fire of machine guns during IDT #6. If training area is not available, this task would be completed prior to firing the qualification course at Annual Training. This plan allows the unit to complete all required gunnery tasks leading to the actual qualification course which is conducted at the Annual Training period. In addition, the pile on weekend training allows increased training on maneuver skills and opportunities for remedial gunnery training.

IDT #1	IDT #2	IDT #3	IDT #4	IDT #5	IDT #6
PRELIMINARY GUNNERY TRAINING	PILE ON	TCGST (a)	TT IV (b) A-FIST	PILE ON	TT V (c)
IDT #7	IDT #8	IDT #9	IDT #10	IDT #11	IDT #12
<b>SOLDIER READINESS ACTIVITIES</b>	PILE ON	TT IV A- FIST	TT VII (d) A-FIST	PILE ON	ANNUAL TRAINING

Figure 10

- a. TCGST= Tank Crew Gunnery Skills Test
- b. TT IV= Tank Table 4: Preliminary Qualification Course
- c. TT V= Tank Table 5: (Machine Gun)
- d. TT VII= Tank Table 7: Stationary/Moving Tank & Target Course

The Annual Training period is an integral part of this seamless training plan. Simulation is integrated throughout the period to support the qualification of crew weapon systems, platoon and battalion maneuver training, and battalion through brigade tactical operations. It is characterized by a compressed gunnery period with the resulting additional time available for maneuver training. This allows units to minimize administrative

time and provides up to 7 days to be spent on maneuver. Crew qualification on Table VIII is completed on day 3 with Platoon Table XII complete on Day 6 (Figure 11).

<b>DAY 1 MOVE FROM HOME STATION SCREEN</b>	<b>DAY 2 TT IV SCREEN</b>	<b>DAY 3 TT VIII</b>	<b>DAY 4 TT XII RECON ROCKDRILL</b>	<b>DAY 5 TT XII (SIMNET)</b>
<b>DAY 6 TT XII</b>	<b>DAY 7 - 13 PLATOON - BATTALION MANEUVER BRIGADE CPX / OPERATIONS</b>			
<b>DAY 14 RECOVERY</b>	<b>DAY 15 MOVE TO HOME STATION</b>			

Figure 11

The result of integrating simulation into a focused training strategy allows mechanized units to train at an increased level, which correspondingly reduces the tasks necessary for training during the post-mobilization period. Crew level qualification and platoon maneuver proficiency are the stated training objectives of the 1993 National Defense Authorization Act.<sup>29</sup> Utilizing this strategy, Enhanced Brigades have qualified all

crews on Table VIII and platoons on, (the previously AC only), Platoon Table XII.<sup>30</sup>

The additional maneuver time allows platoons to achieve the required proficiency on platoon maneuver tasks. This provided the means for training above the stated readiness objective. The unit is able to conduct company and battalion level maneuver and gunnery. The Brigade staff receives intense training by utilizing JANUS as a stand alone scenario driver, or by including the subordinates via the STOW triad. The overall benefit of this total systems approach is that units can train and qualify at increasing levels of competence, and that the required training during the post-mobilization time can be dramatically reduced. This allows ARNG units to become rapidly ready and available for earlier deployment.

### **Impact of Simulation on ARNG Deployability**

The use of technology to replace actual weapons firing or large scale maneuver exercises has many benefits. The most important benefit is the increase in proficiency gained by units. They are able to conduct training and follow-on sustainment training unrestrained from resource and financial limitations inherent in conventional methods. This ability to train in a

unrestrained environment overcomes the time and distance challenges faced by reservists. Units increase their readiness levels and further reduce the amount of time necessary for post-mobilization training.

The use of gunnery simulation provides effective and efficient methods of increasing crew level gunnery proficiency. Crews are able to train on the vast majority of the tasks involved with qualification at home station. Ammunition, fuel, vehicle maintenance, and other costs are saved since they are not required for training the crew for qualification. The ammunition savings alone, shown in Figure 5, for one battalion's pre-qualification training exceeds \$2 million. When combined with the resulting savings in fuel, transportation, and vehicle costs, the monetary costs of simulation devices are greatly reduced.

Another benefit is the increased number of crews that actually qualify on Table VIII. There is a significant increase in the number of crews who qualify on Table VIII who use simulation to replace preliminary gunnery tables as opposed to the traditional method of live firing all tables. Brigades that utilize simulation maintain a 95% average qualification versus the 83% qualification rate for brigades not utilizing simulation throughout the period of FY 93-96.<sup>31</sup> Most importantly, the

brigades that utilize simulation can complete Table VIII on the third day of Annual Training instead of the typical 10<sup>th</sup> or 11<sup>th</sup> day of the 15 day training period. This increase in available training time permits brigades to conduct higher level collective maneuver and gunnery training.

The increase in available training time at Annual Training allows brigades to complete many of the tasks required during post-mobilization. For example, a RAND study conducted in 1996, recommended that post-mobilization gunnery training for ARNG Heavy EBs consist of firing all gunnery tables up to and including platoon Table XII.<sup>32</sup> Simulation has allowed EBs to complete Table XII during Annual Training with additional time to conduct unit maneuver exercises. The qualification of platoons on Table XII eliminates the need to expend 11 days of post-mobilization time on gunnery, based on the RAND study recommendation.

Brigade level tactical proficiency relies not only on gunnery skills, but on maneuver, command and control, and sustainment skills. Since the unit has additional training time, due to the early completion of gunnery requirements, Annual Training periods can now focus on training tactical skills. The utilization of JANUS and other CPX simulation throughout the

year, allows battalion and brigade staffs to train in the command and synchronization of critical Battlefield Operating Systems (BOS). Enhanced Brigades, utilizing simulation, have over seven days of Annual Training to focus on maneuver and tactical training. The institution of a simulation training strategy starts with the training of individual skills. As units attain higher proficiency, the annual training plan elevates to the next echelon. Over a 3-4 year period, EBs using simulation through platoon lanes to the conduct of Company and Battalion level maneuver expertise. Brigades, although restrained by the lack of sufficiently large maneuver areas, can continue to conduct Brigade C2 and synchronization as each battalion conducts live maneuver and through the utilization of CPXs.

Both of the EBs training with simulation are scheduled to complete brigade level NTC rotations by 1998. They have met the FORSCOM Table XII and CALFEX requirements prior to their NTC rotation. The necessary mobilization time for both of these brigades has been reduced from 90+ days to under 45 days. This determination was made by not only the RC commander, but by the associated AC division commander or Regional Training Brigade commander. The Training Assessment Models (TAM) for these units

state that 42 days or less is required for these units to attain tactical proficiency.<sup>33</sup>

However, simulation does not replace entirely all of the training necessary for early deployment. Soldiers and units still need to operate in a field, tactical environment. Soldiers must learn "fieldcraft", the ability to operate and survive in a field environment over extended periods of time. They must qualify with actual weapons and ammunition, and have hands on experience in operating and maintaining equipment, coping with the challenges of the environment, and sustainment. Commanders and units must be able to conduct actual maneuver, deal with real world logistical challenges, and operate successfully in a field environment. The majority of the Annual training period must be devoted to maneuver and tactical skills. The brigade commanders and staffs can execute numerous CPXs to learn the critical C2 and BOS synchronization skills necessary for brigade proficiency. However, these brigades will require either a CTC rotation or time during post-mobilization, to conduct live, sustained operations at the brigade level. They will enter post-mobilization at a high level of training, resulting in a decrease in the time necessary for validation, and an earlier deployment availability.

## **Implications**

The integration of this new technology and strategies into ARNG training has many implications for the future. Many of these are budgetary driven, while others relate to missions and roles, and the amount of dependence that should be placed on the reserves. Each one of these issues has many political, organizational, training biases. A clear vision and decision by policy makers as to the level that reserves will be relied upon for national defense is required. This clear cut distinction will assist in determining the priority for allocation of funds and equipment to the National Guard.

As the military budget and the Army force structure continues to decrease with no peer threat in sight, a higher number of ARNG units can be utilized to sustain an adequate national defense capability. The current Quadrennial Defense Review, and future force structure panels, will focus on the size of the AC force. The elimination of one AC heavy division results in a tremendous decrease in military spending. A small portion of these funds could adequately fund a similar RC division and the simulation devices needed to train it.

The Joint Strategic Capabilities Plan (JSCP) must adequately assign or allocate forces based upon their deployment

availability. As the AC force structure continues to decline, the remaining AC force will have increased emphasis on being rapidly deployable. Since they have fully trained, highly ready forces that can be deployed immediately, they are the best suited for dealing with future, unpredictable crises. Even with the increase in their deployment availability, ARNG combat units should never be considered "rapid deployment" forces. Active forces from all services, must continue to be the point of the spear for dealing with crisis situations. Developing ARNG units that are capable of deploying earlier, will provide the necessary strategic depth as follow-on units, to early deploying AC forces.

The AC should continue to be the military force relied upon to conduct Operations Other Than War (OOTW). The retention of complex skills, such as those used by a soldier in a mechanized combat unit, requires frequent practice for retention. The limited training time available to ARNG combat units must be focused on specific combat skills, and not have these diluted with non-skill related missions. The period of time that it takes to train and sustain the skills of a RC soldier and unit are well above those of the AC. If RC units are routinely committed to OOTW or other missions outside their established

wartime mission, their warfighting capability will rapidly deteriorate.<sup>34</sup>

The cost of training the RC to reach higher levels of readiness requires a significant investment in simulation devices. Many of these costs can be paid by the savings in ammunition and other resource expenditures related to traditional training methods. But many of the initial costs may need to be funded directly out of Operation and Maintenance (O&M) funds used previously to support AC divisions that are now being deactivated. In either case, the funding and allocation of simulation devices should be based on tiered readiness of the RC unit and where the unit resides on the Department of the Army Master Priority List (DAMPL). As in the allocation of other resources, units first in the fight should be the first equipped.

### **Conclusion**

This paper has examined the technology, strategy, and possible outcomes of integrating simulation into ARNG combat unit training. On the surface, this new approach appears to solve most, if not all, of the training inhibitors faced by ARNG units. The outcome of this new approach has been tested and proven to be an effective method to train realistically and economically,

while overcoming the challenges of time and resource shortfalls. The implementation of these systems and strategies relies on numerous factors. Some of these would include locating limited numbers of tactical vehicles with appended simulation devices at local armories, diversion of training and O&M funds to simulation acquisition, and the clear understanding of the strengths and weakness of simulation devices to train specific tasks or missions. The list is by no means complete.

One of the most critical factors affecting this revolution in training is the cooperation and commitment of leaders. The leadership must eliminate biases towards these unique methods of training soldiers. The majority of skills required to fire a weapon or conduct tactical operations can be conducted in simulation. These skills lay the foundation for tactical proficiency and can be learned and mastered without expending the time and valuable resources required to conduct live maneuver and gunnery.

The ARNG has sufficient expertise and school capability to train the unit trainers in the use of simulation. The key to success of simulation relies on the soldiers acceptance of simulation as an alternative method of training. The attitude of the leadership is critical to the acceptance of simulation by the

soldiers. Leaders must be educated into the methodology and integration of simulation into a viable training strategy.

As the AC is drawn down in strength, greater reliance on the ARNG to meet the nation's defense needs will exist. A portion of the funds previously used to sustain now deactivated divisions should be shifted to support the training and sustainment of ARNG combat units. Once simulation is in place within these ARNG units, funds can be returned to the budget due to the reduced usage of ammunition and other training resources.

Simulation is an effective tool that can dramatically increase the readiness of the ARNG's mechanized units. By integrating simulation into a well defined, focused training strategy, ARNG units can achieve a significant increase in readiness and combat proficiency. These units will be well trained with shortened post-mobilization needs. This will provide the required, early deployable forces necessary to meet the defense needs of the U.S. in the future.

## ENDNOTES

<sup>1</sup>Stephen M. Duncan, Citizen Warriors (Novata, CA:Presidio, 1997), 84.

<sup>2</sup>Michael Maser, The Military Technical Revolution. A Structural Framework (Washington, DC: Center for Strategic and International Studies, March 1993), 16.

<sup>3</sup>John F. Kane, Emerging Training Technologies and the Army National Guard (Carlisle, PA: U.S. Army War College, 21 March 1986), 7-8.

<sup>4</sup>William A. Navas, Jr., "The Army National Guard: Flexible, Accessible Force," Army 46, no. 10 (October 1996): 94.

<sup>5</sup>William A. Navas, Jr., Fiscal Year 1997, Posture Statement, 16 January 1996, <<http://132.80.130.121/p97b.htm>>, 16 January 1996.

<sup>6</sup>Office of the Assistant Secretary of Defense, "The National Guard and Reserve - Twenty-Five Years of Strength in Partnership," <<http://raweb.osd.mil/docs/fnladr96.htm>>, 28 December 1996.

<sup>7</sup>Robert Holzer, "ARPA Seeks to Boost Guard Readiness," Defense News, (4 October 1993): 16.

<sup>8</sup>Congress, House, Committee on Armed Services Subcommittee on Readiness, Army Training: Commanders Lack Guidance and Training for Effective Use of Simulation, report prepared by the U.S. General Accounting Office, 23 August 1993, p. 4.

<sup>9</sup>John E. Morrison, "Devices and Aids for Training M1 Tank Gunnery in the Army National Guard: A Review of Military Documents and the Research Literature," Defense Technical Information Center, (September, 1991): 49-51.

<sup>10</sup>John R. D'Araujo Jr., "Army National Guard: A vision for the Future," Army 45, no. 10, (October 1995): 89.

<sup>11</sup>David McLin, Virtual Maintenance Trainers for the National Guard, Research Triangle Institute (November 1996):1-2.

<sup>12</sup>Fact Sheet, distributed by Project SIMITAR, 15 March 1996.

<sup>13</sup>PENCIL Functional Specification, Version 1.1, distributed by DARPA, 10 December, 1994.

<sup>14</sup>William A. Navas, Jr., "Fiscal Year 1997, Posture Statement," 16 January 1996, <<http://132.80.130.121/p97b.htm>>, 16 January 1996.

<sup>15</sup>Engagement Skills Trainer Fact Sheet, distributed by Firearms Training Systems, Inc., September, 1995.

<sup>16</sup> ARSI Briefing Charts, distributed by DARPA and Texas Instruments.

<sup>17</sup>Michael Hayes, "Army National Guard Goes Into Battle at DSI Users Conference," AITS-JPO News (May 1996): 10.

<sup>18</sup>JANUS Trainers Handbook, distributed by Project SIMITAR.

<sup>19</sup>TRADOC, "Brigade/Battalion Battle Simulation," <<http://hp01.arc.iquest.com/mosaic/036.html>>, 23 December 1996.

<sup>20</sup>TRADOC, "Corps Battle Simulation," <<http://hp01.arc.iquest.com/mosaic/061.html>>, 23 December 1996.

<sup>21</sup>U.S. Atlantic Command, STOW 97 Advanced Concept Technology Demonstration (ACTD), Management Plan Version 7.0, 2.

<sup>22</sup> TRADOC, "WARSIM 2000 - Warfighter's Simulation 2000", <<http://hp01.arc.iquest.com/mosaic/313.html>>, 23 December 1996.

<sup>23</sup>Ibid.

<sup>24</sup>John M. Shalikashvili, Joint Vision 2010, Vision Statement of the Chairman of the Joint Chiefs of Staff, (Washington: Department of Defense, 1996), 25.

<sup>25</sup>Department of the Army, Force XXI Operations, TRADOC Pamphlet 525-5 (Ft. Monroe, VA: U.S. Department of the Army, 1 August 1994), 4-3.

<sup>26</sup>U.S. Atlantic Command, STOW 97 Advanced Concept Technology Demonstration (ACTD), Management Plan Version 7.0, 6.

<sup>27</sup>Ibid., 1.

<sup>28</sup>116<sup>th</sup> Cavalry Brigade Information Paper, "Pile-On Weekend," 25 April 1995.

<sup>29</sup>Department of the Army Forces Command, Reserve Component Training in America's Army, FORSCOM Regulation 350-2 (Washington: U.S. Department of the Army, 1 February 1996), 38.

<sup>30</sup>116<sup>th</sup> Cav Bde, Annual Training 96: Final AAR, Gowen Field, Idaho, July 1996.

<sup>31</sup>Institute for Defense Analysis, Enhanced Brigade Training Analysis (Working Draft), 20 March 1997, Table IV-9.

<sup>32</sup>RAND, Postmobilization Training Resource Requirements: ARNG Heavy Enhanced Brigades (Washington: RAND, 1996), Table A1.

<sup>33</sup>FORSCOM, "48<sup>th</sup> and 116<sup>th</sup> ARNG Brigade Training Assessment Models," TY 95 & 96.

<sup>34</sup>Duncan, 222-229.



## BIBLIOGRAPHY

- D'Araujo, John R. Jr. "Army National Guard: A vision for the Future." Army 45, no. 10 (October 1995): 89.
- DARPA and Texas Instruments. ARSI Briefing Charts.
- DARPA. PENCIL Functional Specification. Version 1.1. 10 December 1994.
- Duncan Stephen M. Citizen Warriors. Novata, CA: Presidio, 1997.
- Firearms Training Systems, Inc. Engagement Skills Trainer Fact Sheet. September, 1995.
- Hayes, Michael "Army National Guard Goes Into Battle at DSI Users Conference." AITS-JPO News (May 1996).
- Holzer, Robert. "ARPA Seeks to Boost Guard Readiness." Defense News (4 October 1993): 16.
- Idaho Army National Guard, 116<sup>th</sup> Cav Bde. Annual Training 96: Final AAR. Gowen Field, Idaho, July 1996.
- \_\_\_\_\_. "Pile-On Weekend". 25 April 1995.
- Kane, John F. Emerging Training Technologies and the Army National Guard. Carlisle, PA: U.S. Army War College, 21 March 1986.
- McLin, David. "Virtual Maintenance Trainers for the National Guard." Research Triangle Institute. (November 1996).
- Morrison, John E. "Devices and Aids for Training M1 Tank Gunnery in the Army National Guard: A Review of Military Documents and the Research Literature." Defense Technical Information Center. (September, 1991).
- Navas, William A. "Fiscal Year 1997, Posture Statement." 16 January 1996. <<http://132.80.130.121/p97b.htm>>. 16 January 1996.
- \_\_\_\_\_. "The Army National Guard: Flexible, Accessible Force."

Army 46, no. 10, (October 1996): 94.

Project SIMITAR Fact Sheet. 15 March 1996.

\_\_\_\_\_. JANUS Trainers Handbook.

Shalikashvili, John M. Joint Vision 2010. Vision Statement of the Chairman of the Joint Chiefs of Staff. Washington: Department of Defense, 1996.

U.S. Assistant Secretary of Defense. "The National Guard and Reserve - Twenty-Five Years of Strength in Partnership." <<http://raweb.osd.mil/docs/fnladr96.htm>>. 28 December 1996.

U.S. Atlantic Command. STOW 97 Advanced Concept Technology Demonstration (ACTD). Management Plan Version 7.0.

U.S. Congress. House. Committee on Armed Services Subcommittee on Readiness. Army Training: Commanders Lack Guidance and Training for Effective Use of Simulation. Report prepared by the U.S. General Accounting Office, 23 August 1993.

U.S. Department of the Army Forces Command. Reserve Component Training in America's Army. FORSCOM Regulation 350-2. Washington: U.S. Department of the Army, 1 February 1996.

U.S. Department of the Army Training and Doctrine Command. Force XXI Operations. TRADOC Pamphlet 525-5. Ft. Monroe, VA: U.S. Department of the Army, 1 August 1994.

\_\_\_\_\_. "Brigade/Battalion Battle Simulation". <<http://hp01.arc.iquest.com/mosaic/036.html>>. 23 December 1996.

\_\_\_\_\_. "Corps Battle Simulation". <<http://hp01.arc.iquest.com/mosaic/061.html>>. 23 December 1996.

\_\_\_\_\_. "WARSIM 2000 - Warfighter's Simulation 2000".  
<<http://hp01.arc.iquest.com/mosaic/313.html>>. 23 December  
1996.